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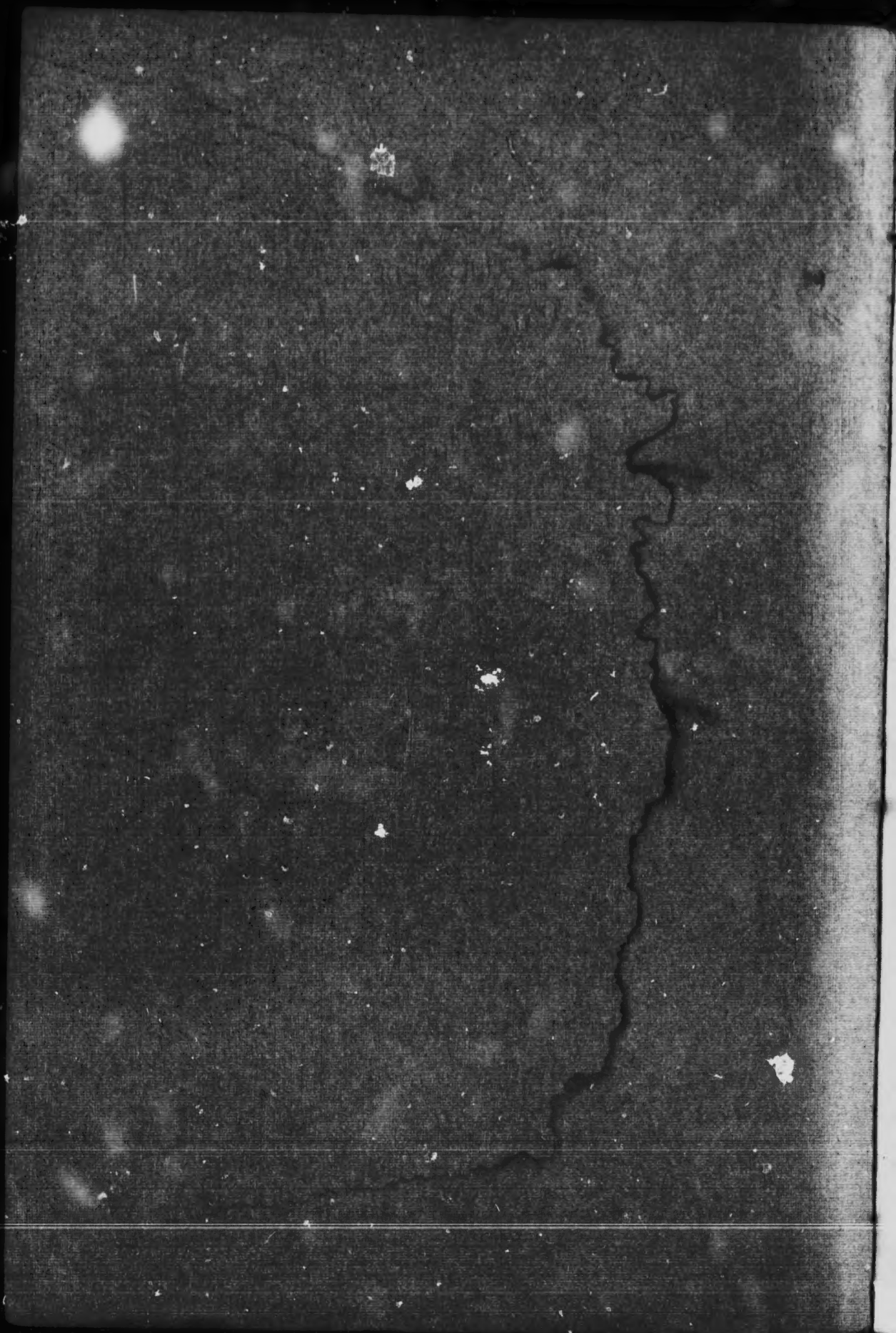
Wheaton District, Southern Yukon

By D. D. CAIRNES

SUPPLEMENT TO MEMOIR 31.

(No. 1620)



Wheaton District, Southern Yukon.[1]

(D. D. Cairnes.)

INTRODUCTION.

The early part of the past season (1915) was spent in Wheaton district, southern Yukon. During the summer of 1909, the writer made a photo-topographic survey of this area, and at the same time made a geological examination of the district. The geological mapping was, however, necessarily of only a preliminary nature, owing to the fact that at the time no topographic map was available upon which to plot the various geological formations, and all geological outcrops, contacts, etc., had to be recorded in note form only, which is at best very unsatisfactory. The topographic work performed by the writer in 1909 was compiled by the topographic division of this Department, and advance sheets suitable for field work became available last spring, affording thus an opportunity to revise the previous geological mapping in a satisfactory manner, using this map as a topographic base. Another important reason for performing geological work in Wheaton district at this time, was that a number of important deposits of antimony minerals wereknown to occur within the area, which have been more or less developed since 1909, and since the war there has been an increased demand for antimony and its price has advanced greatly. The writer accordingly received instructions to revise the geological mapping of Wheaton district, and to make an examination of the mineral deposits occurring within its boundaries, particular attention to be paid to those containing antimony minerals.

[1] For further information concerning the geology, mineral resources, topography, and other features of Wheaton district, the reader is referred to the following more detailed report:
Cairnes, D. D., "Wheaton district, Yukon Territory"; Geol. Surv., Can., Memoir No. [illegible] 1912.

The topographic map upon which the geology was plotted is published to a scale of 1:63360, or approximately one mile to the inch, and every care was taken to have the geological mapping performed so as to be consistent with this scale.

The writer was ably assisted in this work by William Cockfield.

LOCATION AND AREA.

Wheaton district is situated in the southern portion of Yukon Territory, its southern edge being from 12 to 15 miles north of the 60th parallel of latitude (the British Columbia-Yukon boundary). The area included is approximately

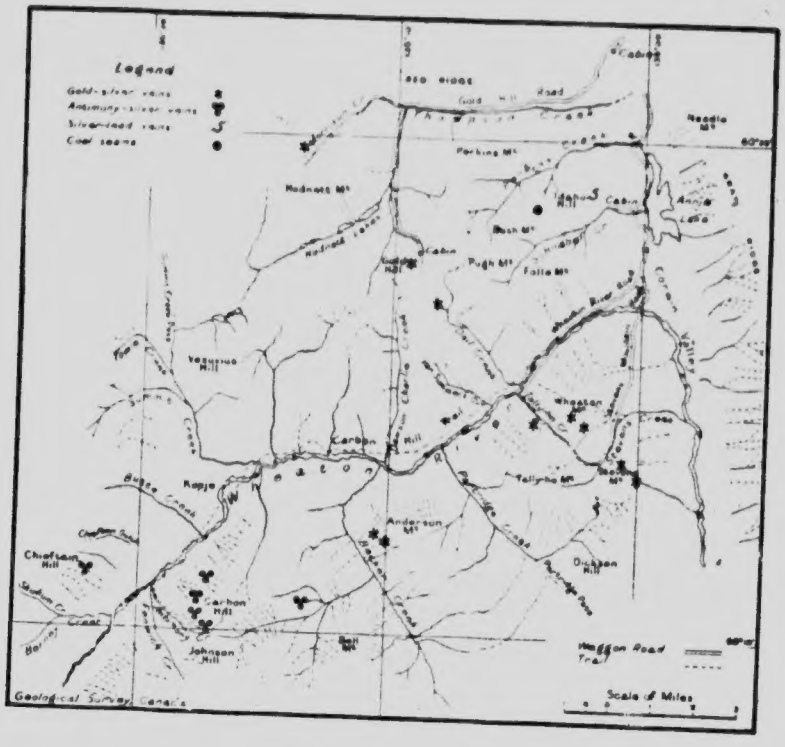


Figure 2. Wheaton district.

20 miles long in an east and west direction, and 15 miles wide from north to south. The district is flanked on the west by the eastern slopes of the mountains of the Coast range, and extends thence eastwards to longitude 135° 53′, or to within a distance, as the crow flies, of 6 miles from the White Pass and Yukon railway. Wheaton river which has given its name to the area, flows, throughout the lower portion of its course, in a general direction almost due south, and empties into Lake Bennett; 12 miles above its mouth, however, the river turns abruptly to the west forming what is known as the "Big Bend" of the Wheaton, and throughout the portion of its course from the Big Bend to near its headwaters, the stream flows in a general easterly to northeasterly direction. Wheaton district, as the term is here used, includes only the particular area mapped in 1909; this area extends along both sides of Wheaton river from above 6 miles below the Big Bend, to about 18 miles above it.

MEANS OF COMMUNICATION.

Wagon roads have been constructed by the Yukon government, from Robinson on the White Pass and Yukon railway, to various parts of the district. One road extends along Wheaton river to Carbon hill which is situated in the most westerly portion of the area, about 30 miles distant from Robinson; and a branch from this main road has been built to Stevens camp, near the summit of Mt. Stevens. Another road 20 miles long, has been constructed from Robinson to Gold hill which lies 3 to 4 miles north of Wheaton river, and midway between that stream and Watson river. All parts of the district are thus easily accessible, and only short, easily constructed branch roads are necessary to connect all the mineral properties, not already so connected, with the railway.

Robinson is distant 78 miles, by rail, from Skagway, Alaska, whence several lines of well equipped steamships sail regularly to Vancouver and Seattle, distances, respectively, of 867 and 1,000 miles.

TOPOGRAPHY.

Topographically, Wheaton district occupies a position along the extreme western edge of the Yukon Plateau physiographic terrane, and is thus bordered on the west by the mountains of the Coast range. There is here, however, no very marked distinction between the land features of these two topographic provinces along their boundary; in fact, in most places, it is difficult to decide just where the dividing line should be placed.

Within Wheaton district, possibly the most striking point in connexion with the topography is the marked contrast between valleys and upland, both of which possess very pronounced characteristics. The valleys are typically deep, steep-sided depressions the walls of which rise abruptly 2,000 to 3,000 feet to the upland above. Between these incision-like valleys, high gently rolling stretches of an upland surface occur, there being everywhere an abrupt change representing a topographic unconformity at the junction of the upland with the tops of the valley walls. This upland constitutes part of an old plateau which possessed only slight relief and extended, practically unbroken, from the mountains of the Coast Mountain system on the west, eastward to the Rocky mountains, a distance of from 250 to 300 miles. Even yet, to an observer standing on this upland surface, well back from the edge of a valley wall so vast an expanse of gently rolling surface presents itself to his view, that it is easy to imagine the intersecting valleys again refilled or to forget that they have ever been excavated; and thus a picture of the landscape as it existed before the valleys were incised, is presented.

This plateau is generally conceded to represent a maturely eroded surface, that was reduced by ordinary normal erosion processes to a nearly plain-like condition, during a long period throughout which this portion of the earth's crust remained relatively stable. The erosion interval was interrupted, however, in what is thought to be late Tertiary time by a regional uplift which in Wheaton district amounted to about 3,600 feet, and as a result of this crustal movement a lowland tract became a highland surface. The uplift gave renewed life and energy to the streams which were thus soon able to cut deep, V-shaped incisions into the new upland, and these now constitute the main valleys of the district. At a later period glacial ice invaded Wheaton district, and occupied all the main depressions which as a result of ice action, became both widened and deepened, and gradually assumed pronounced U-shaped cross-sections. Also, such well known glacial forms as cirques, hanging valleys, roches moutonnées, and kettle-holed valley floors were produced. The morainal and other materials which were deposited in the valley bottoms, blocked the stream courses in different places to such an extent that even

yet the drainage is very imperfect, and lakes or ponds, many of them surrounded by muskeg or tundra, now occupy important depressions, through which large and important tresams once flowed.

Since the retreat of the ice, V-shaped incisions have been etched in the valley walls, and at the margins of the upland surface, resulting in the production between them of pronounced facetted forms. The main streams have also sunk their channels to some extent in the unevenly distributed deposits strewn over the valley floors, so that occasional sand, gravel, silt, or boulder-clay banks, 200 feet or more in height, have been produced. Disregarding these relatively slight changes, however, the topography of Wheaton district is as the ice left it, and the forms or features which were produced by glaciation still exist in a marked state of preservation.

GENERAL GEOLOGY.

General Statement.

Wheaton district is situated, as before mentioned, along the eastern edge of the Coast range, and practically the entire area is believed to be underlain by the granitic rocks of the great Coast Range batholith; which outcrop throughout by far the greater part of the area. A study of the geology of Wheaton district thus involves throughout, that of this important granitic terrane. In addition to the granitic intrusives, however, which are of Cretaceous or Jurassic age, numerous other rock types occur, including igneous, sedimentary, and metamorphic varieties which range in age from possibly Pre-Cambrian to Recent.

In the eastern portion of Wheaton district, the present upland surface very nearly coincides with the original top of the Coast Range batholith, so that there, numerous remnants of the former roof of this igneous mass are still preserved. The older rocks also constitute walls separating subjacent portions of this vast granitic body; in addition, numerous small isolated masses of the older invaded formations remain, which are distinctly seen to be inclusions in the granitic intrusive, occurring as they do throughout it at various elevations. Toward the west, nearer the centre of the batholith, the older rocks gradually disappear, as the central portion which was originally the highest has been more deeply eroded than the rest and, as a result, the overlying and included older rocks, all of which were originally mainly at or relatively near the surface of the batholith, have been to a great extent removed.

Throughout Wheaton district the geology is complicated and intricate, due in part to the great diversity in age and character of the various formations that occur, but more particularly to the fact that the area has been subjected to a number of intense volcanic invasions. As a result of each invasion the older rocks have been cut pierced, and in some cases buried by the invading volcanics, and so each successive period of volcanic activity added to the geological complexity of the region.

Table of Formations.[1]

Era	Period	Formation	Lithological character
Quaternary		Superficial deposits	Gravel, sand, clay, silt, soil, muck, volcanic ash, ground-ice, slide rock, and morainal materials.
Tertiary	Probably mainly about Pliocene, but may include older members, and may also continue up into the Pleistocene		Rhyolite, granite-porphyry, and related volcanics, with their associated tuffs and breccias. Some granitic types also occur.
			Andesite, basalt, and related dyke rocks and other volcanics, with their associated tuffs and breccias.
Mesozoic	Cretaceous to Jurassic	Coast Range intrusives	Granitic rocks ranging in composition from granite to diorite, with associated porphyritic phases.
	Probably Lower Cretaceous		Andesite, diabase, basalt, and related volcanics, with associated tuffs and breccias.
	Lower Cretaceous or Jurassic	Laberge series	Argillite, metargillite, shale, sandstone, arkose, greywacke, conglomerate, and breccia.
	Jurassic	Probably corresponds to the Kootenay	Conglomerate with sandstone, shale, and seams of coal.
Palæozoic	Carboniferous(?)		Limestone, more or less dolomitic.
	Devonian (?)		Pyroxenite mainly—probably peridotite and related rocks also occur.
Pre-Cambrian (?)		Mt. Stevens group	Chiefly sericitic and chloritic schists, mashed basic to semi-basic volcanics, gneissoid quartzite, hornblende gneiss, and limestone.

Summary Description of Formations.

The oldest rocks known to occur in Wheaton district are included in the Mt. Stevens group, and are chiefly sericite and chlorite schists, mashed basic volcanics, gneissoid quartzites, hornblende-gneisses, and limestones. These occur in a number of localities, but in most places constitute only small isolated outcrops representing remnants of the roof of the Coast Range batholith, or inclusions in that igneous mass. In the eastern part of the district, however, one particularly extensive development of these rocks occurs, constituting a long, deep wall dividing subjacent portions of the granitic batholith; this wall has been cut by Wheaton

[1] The rocks of Wheaton district have been here somewhat differently subdivided and classed than in the writer's previous work to which reference has been made. This change has been found advisable after a number of years further geological study in Yukon—one of the chief reasons for the rearrangement being that by grouping the rock terranes as here shown, they may be much more readily correlated with the rock formations now known to occur elsewhere in Yukon as well as in northern British Columbia and Alaska.

river to a depth of nearly 3,000 feet, and it appears to persist to still greater depth. All the members of the Mt. Stevens group suffered prolonged dynamic metamorphism, were much disturbed, broken, contorted, and plicated, and were afterwards subjected to long periods of erosion, concerning which relatively little is known. They are thought to be, in all probability, of Pre-Cambrian age.

More recent than the members of the Mt. Stevens group are certain pyroxenites with which are probably associated peridotites and related rocks. Outcrops of the pyroxenites were seen only in one small area situated on the southern portion of Tally-Ho mountain, and at this point they cut the members of the Mt. Stevens group. No other definite information was obtained in the district concerning the age of these rocks, but from their lithological similarity to rocks in other portions of Yukon and in northern British Columbia, they are thought to be probably of about Devonian age. In the writer's former report on this district, these rocks were included in the Perkins group, a name the use of which it is now considered advisable to discontinue.

At a few points, mainly along the west face of Needle mountain, and on Idaho hill, small isolated masses of limestone occur, which rarely exceed 100 feet in thickness, and are merely detached blocks that have been carried upward by igneous masses mainly by the Mesozoic andesitic rocks or by the Coast Range intrusives. On the south face of Mt. Bush a fairly persistent bed of limestone, apparently about 6 feet in thickness, also occurs underlying the coal-bearing conglomerates. The isolated limestone masses, as well possibly as the bed on Mt. Bush, are thought to be probably of Carboniferous age. None of this limestone, however, is of any particular areal importance.

In Mesozoic times a considerable thickness of arenaceous and argillaceous sediments was deposited in this portion of Yukon. In Wheaton district these have been for the greater part removed by erosion, but in the northeast corner of the area they are in part still preserved, and have there an aggregate thickness of 5,000 to 6,000 feet. These sediments are divisible into two groups or formations—the Laberge series, and a conglomerate series which appears to correspond to the Kootenay. The Laberge beds consist mainly of argillites, metargillites, shales, and sandstones, with also some arkoses, greywackes, conglomerates, and breccias. A few indefinite or poorly preserved invertebrate fossil remains have been found in these beds, which have been considered to be of either Lower Cretaceous or Jurassic age. The conglomerate series which in places has a total thickness exceeding 1,000 feet, appears to underlie the Laberge beds, but of this no absolute proof could be obtained, owing to the greatly disturbed condition of these sediments. The conglomerate formation consists prevailingly of a fine to medium textured, dark, cherty conglomerate, with also some sandstones, shales, and seams of coal. Fossil plants were collected from these beds during the past summer, which have been determined by Dr. F. H. Knowlton of the United States Geological Survey, to be of Jurassic age. Dr. Knowlton also states that some of the species have been found in the Kootenay or at least have been reported from that formation. Since, therefore, these beds contain coal seams, and are lithologically very similar to the Kootenay members farther south, they would seem in all probability, to belong to that formation.

More recent than these sediments, there occurs an important group of volcanic rocks including mainly andesites, diabases, basalts, and related volcanics, with their associated tuffs and breccias, which have extensively invaded the older rocks of the district. This volcanic group appears to represent the same period of volcanic activity as the "Older Volcanics"[1] of Upper White River district, and other portions of Yukon and Alaska.

[1] Cairnes, D. D., "Upper White River district, Yukon"; Geol. Surv., Can., Memoir 50, 1915, pp. 87-93.

These volcanics are in turn cut by the Coast Range intrusives, which constitute much the most important and most extensively developed geological terrane in the district. These intrusives range in composition from granite to diorite or may be even more basic in character; they appear to be dominantly, however, of about the composition of granodiorite, and have everywhere a pronounced granitic habit. These rocks were first thought to be all of Jurassic age, and when working in Wheaton district in 1909, boulders of these intrusives were found in the lower conglomerate beds of the Laberge series. The intrusives were considered, therefore, to antedate these sediments in age. Since that time, further work in other portions of Yukon as well as in northern British Columbia, where contacts between the Coast Range intrusives and the members of the Laberge series are better exposed, has shown that the intrusives also cut the Mesozoic beds, and are partly older and partly younger than these sediments.[1] In fact recent studies of the Coast Range batholith in different districts, have shown that this terrane represents several intrusive periods ranging from some time in the Jurassic to well into Cretaceous time. This has given rise to considerable difficulty and complexity in connexion with geological work in the vicinity of the Coast Range batholith. In Wheaton district, it is now known that these rocks are dominantly at least or perhaps entirely, more recent than the Mesozoic sediments, and are probably all of Cretaceous age. In the writer's former work in this district, certain andesitic and related volcanics were known to be older than the Coast Range intrusives, and were consequently believed to be older than the Mesozoic sediments, and were included in the Perkins group. Other similar andesites and related volcanics were known to be more recent than the Laberge members and were grouped separately under the name Chieftain Hill volcanics. All these andesitic and related volcanics are now regarded as belonging to the same formation, as just described, and as shown in the above table of formations.

Cutting the Coast Range intrusives, there occurs an important group of volcanic rocks comprising mainly andesites, basalts, and related volcanics, including various types of dyke rocks, with their associated tuffs and breccias. These rocks are quite extensively developed in the extreme western portion of the district, and are everywhere quite recent in appearance—lava flows in which the flow structure is still very marked, and beds of tuff and ashes, constituting probably the most prominent members. These rocks correspond to the "Newer Volcanics" of Upper White River district,[2] and other portions of Yukon, and include the Carmack basalts. They are considered to be of Tertiary and probably of late Tertiary age.

Another important group of volcanic rocks, includes mainly rhyolites, granite-prophyries, and related rocks, which are the most recent consolidated rocks of the district, and are of late Tertiary or possibly even in part of early Pleistocene age. These volcanics do not generally cover any very large individual areas, but occur rather as dykes and similar intrusive bodies. Innumerable dykes occur cutting the Coast Range intrusives and other older rocks, and in certain localities so extensive has been the invasion of these volcanics that they appear to be almost as prominent as the invaded formations. In places these volcanics have quite a marked granitic habit, and might locally be termed porphyritic granites or, possibly, granites. In the writer's previous work on Wheaton district, these rocks were divided into two groups: one including the rhyolitic members which were termed the Wheaton River volcanics, and the other the granite-porphyries, which were named the Klusha intrusives. This subdivision has since been found to be somewhat impracticable, particularly in adjoining

[1] Cairnes, D. D., "Atlin Mining district, British Columbia"; Geol. Surv., Can., Memoir No. 37, 1913, p. 59.
[2] Cairnes, D. D., "Upper White River district, Yukon"; Geol. Surv., Can., Memoir 50, 1915, pp. 97-101.

districts where every transition occurs between these two lithological phases of apparently the same rock magma.

Overlying all the consolidated rock formations of the district are the Pleistocene and Recent accumulations which include mainly gravels, sands, clays, silts, soils, muck, volcanic ash, ground-ice, slide rock, and morainal materials. These accumulations not only deeply cover all the main valley bottoms of the district, but in addition extend over considerable portions of the upland as well as of the valley walls.

MINERAL RESOURCES.

General Statement.

The mineral resources of Wheaton district embrace, mainly, ore deposits of different kinds, but also include coal. The ore deposits are of four principal types, viz:

(a) Gold-silver veins.
(b) Antimony-silver veins.
(c) Silver-lead veins.
(d) Contact-metamorphic deposits.

Of these varieties the gold-silver and the antimony-silver veins are of the most importance. The silver-lead veins are quite limited in extent, and the contact-metamorphic deposits, so far discovered, are too low grade, and are insufficient in size to be of any present economic importance. Coal has been found only in one locality, on Mt. Bush, and has been only slightly prospected. All these mineral deposits are described in the writer's report[1] on Wheaton district, and in most cases will not require to be more than briefly mentioned. Detailed descriptions are given of the antimony deposits, and of certain of the other deposits on which important development work has been performed since the previous examination in 1909.

Gold-Silver Veins.

General Statement. Veins of the gold-silver variety constitute the most widely distributed type of ore-deposit found in Wheaton district. The more important of these veins that have been so far discovered, occur on Mt. Anderson, Mt. Stevens, Wheaton mountain, Gold hill, and along the south side of Watson river to the north of Hodnett mountain. On the various deposits occurring on Gold hill, Hodnett mountain, and to the north of Hodnett mountain along the south side of Watson river, no development work has been performed, except possibly a slight amount of representation work, since they were visited by the writer in 1909.[2] On the south side of Gold hill, near the head of Dail creek, a vein occurs which is typical of the veins in this locality, and has not been before described. This vein occurs in a fissure in the Coast Range granitic rocks, strikes about 8 degrees south of east,[3] and dips at angles of from 75 to 85 degrees to the south; and where exposed in Dail creek has a width of from 8 to 20 inches, and is at an elevation of about 4,800 feet above sea-level, or 2,100 feet above the mouth of Dail creek. The vein consists mainly of white quartz which is somewhat iron-stained, and in most places contains disseminated galena, and occasional particles of a black telluride which appears to be sylvanite. Three samples were taken from the vein. Nos. 1 and 2 are averages across the vein where it has thicknesses of 14 and 20 inches respectively. No. 3 is an average of a number of particularly well mineralized specimens. These samples upon being assayed, were found to contain:[4]

[1] Cairnes, D. D., "Wheaton district, Yukon Territory"; Geol. Surv., Can., Memoir No. 31, 1912, pp. 85-146.
[2] Ibid, pp. 111-113.
[3] All bearings given in this report unless otherwise mentioned are astronomic or true. The magnetic declination throughout the district averages about 32° 30′ east.
[4] All the assays quoted in this report were made at the Government assay office at Whitehorse.

Sample No.	Gold		Silver		Total value per ton gold and silver
	Ozs. per ton	Value per ton	Ozs. per ton	Value per ton	
1	0·25	$5.00	0·75	$0.37	$5.37
2	0·11	2.20	1·99	0.99	3.19
3	1·51	30.20	15·74	7.87	38.07

On Mt. Stevens as well as on Wheaton mountain, a number of claims are still held, but practically no development work has been performed since 1909, except the relatively small amount required by law to hold the properties, and several claims have been crown granted. On the Buffalo Hump group[1] on Mt. Stevens, several tons of rich quartz were at one time discovered, which contained galena, native gold, and sylvanite. This quartz was at first thought by the owners to be in place, but subsequent development work showed it to be transported. Since this quartz occurred in such quantity near the summit of the mountain, and showed no evidence of having been moved any considerable distance, it would seem most probable that it would be found in place somewhere on Mt. Stevens. Other smaller pieces of rich quartz have also been discovered at other points on the mountain. An adit was driven 90 feet into the hill underneath the rich quartz, and some 30 feet of crosscuts or drifts were driven from the adit, in the hope of finding the vein from which the gold-telluride quartz was derived; but, apparently, no more of the rich ore was encountered. It has been claimed though, that a galena-bearing vein was crosscut by the adit; on each occasion when this property was visited by the writer, however, the adit was filled with ice and could not be examined. In addition to this work and a 20-foot shaft on the McDonald fraction on Wheaton mountain, the only development work that has been performed on Mt. Stevens and Wheaton mountain consists of a number of open-cuts, trenches, and shallow pits. All the veins that have been discovered seem to carry very low average values. Possibly the most promising vein on Wheaton mountain is that exposed on the McDonald fraction.[2] This vein was fairly well exposed in an open-cut and several average samples were taken from it. Approximate average samples were also taken from the dump at the 20-foot shaft on this claim. These samples all assayed less than $1 per ton in combined gold and silver.

The thickest, most persistent, and apparently the best mineralized vein exposed on the Buffalo Hump group, occurs on the Sunrise claim. This vein occurs in a fissure in the Coast Range granitic rocks, strikes south 45 degrees east, and dips at angles of 20 degrees to 35 degrees to the northeast. It is composed dominantly of quartz which contains occasional disseminated particles of galena and pyrite. Several average samples from this deposit where it is exposed at the surface, were assayed, and found to contain less than $1 per ton in combined gold and silver. High assay values have undoubtedly been at times obtained from the veins of this locality, but the values are very erratically distributed. The rich float, also, has been derived, in all probability, from high grade pockets in veins similar to those already found; in fact, it is more than probable that it came from some of the veins already known to occur on Mt. Stevens.

On the Tally-Ho group[3] on Tally-Ho mountain, an important vein occurs on which considerable underground development work has been done though practically only representation work has been performed since it was last examined.

[1] Ibid, p. 107.
[2] Ibid, p. 108.
[3] Ibid, pp. 108-110

On Mt. Anderson, on the east side of Becker creek, a number of claims are owned by Becker and Cochran, on which an important amount of development work has been recently performed—this being really the only vicinity in which there have been any important mining operations in connexion with veins of the gold-silver type, since the district was formerly examined.

Becker-Cochran Property. A number of mineral claims owned by Theodore Becker and Howard Cochran have been located on the west face of Mt. Anderson, about 2 miles south of Wheaton river, measured as the crow flies. These claims comprise the Whirlwind and Mountain Sheep groups which adjoin one another, and consist of 6 and 5 claims respectively, including the old "Rip" and "Wolf" claims.[1] What appear to be two main veins, and one or more others of less importance, have been discovered on these claims, all of which occur in fissures in the Coast Range granitic intrusives. The veins extend along the face of Mt. Anderson for a distance of 2,000 feet or more, and outcrop at elevations of from 4,600 to about 5,050 feet above sea-level, the elevation of Wheaton river at the mouth of Becker creek, being slightly over 2,800 feet above the level of the sea. The greater part of the development has been performed on the Whirlwind group on what is termed the "lower vein" which strikes about north 68 degrees west and dips to the northeast at angles ranging from 80 degrees to nearly vertical. The vein consists chiefly of quartz which is mineralized with argentiferous galena. A striking feature in connexion with this vein is that it has been invaded by a basalt dyke about 2 feet in thickness, which persistently accompanies it throughout its entire length as far as explored. This dyke in places occurs along the hanging wall, and at other points follows along the foot-wall, but generally occupies an intermediate position within the vein; in places also the dyke branches into two or more portions all of which may be included within the quartz. A drift known locally as "No. 2 tunnel," has been driven in on this vein about 350 feet, throughout which distance the quartz has a thickness in most places of from about 8 inches to 4 feet, and maintains a general average exceeding 18 inches. At the entrance to the drift, the quartz has a total thickness of 6 feet, the basalt dyke occurring within 12 inches of the hanging-wall. About 150 feet below this drift, a crosscut 172 feet long has been driven to the vein and a drift from the end of the crosscut follows the vein for about 150 feet. The crosscut and drift together are generally termed by the owners "No. 1" or "the lower tunnel." Throughout this lower drift, the quartz has a thickness of from 6 inches to 4 feet with an average of perhaps 18 to 20 inches.

Continuing to the southeast along the face of Mt. Anderson, vein outcrops have been exposed by a number of pits, small open-cuts, or trenches, for a distance of, possibly, 2,000 feet. These vein outcrops show the same characteristics as the lower vein just described, and are persistently accompanied by the same basalt dyke or by a very similar one. They may be portions of two or possibly three additional veins, or may be a southeasterly extension of the lower vein, that has been successively offset in an easterly direction, farther and farther into the mountain by transverse faulting. A surveyed plan of all vein outcrops gives support to this theory, showing as it does three fairly definite and distinct lines of outcrops, with similar strikes, but swinging successively more to the east as the south is approached, and each line of outcrops commencing practically opposite the last outcrop of the next line of exposures. On the Mountain Sheep group the most southeasterly of the three lines of outcrops, there occurs an exposure, designated by the owners, the "big showing." There vein is somewhat complex or irregular in form, but the quartz has an thickness of from 3½ feet to 4½ feet, and is well mineralized. About 100

[1] 11

feet past this showing, an adit or crosscut was driven into the hill during the winter of 1914-15, in a direction at right angles to the general strike of the vein at the "big showing," but no evidence of the vein was encountered, although the adit was driven some distance past the point where it would have been crosscut had it continued this far in regular fashion. Since the vein had persisted so far, and was strong and well defined within 100 feet of this crosscut, it would appear most probable that it has been further offset by a fault similar to those already indicated. All the available evidence is, therefore, in favour of the fault theory, though its truth can be established only by further development.

The lower vein in the lower drift has been carefully sampled throughout by the owners, and is claimed by them to average $10.60 per ton in gold, silver, and lead, mainly in silver and lead, there being 8·26 per cent lead which was computed at 4 cents per pound. The total average values in the upper drift are slightly less than $10. The gold as a rule is quite low, but exceptional samples have been obtained that carried as much as 3 ounces per ton, and particularly well mineralized samples occasionally contain gold, silver, and lead to the value of $60 to $80 per ton.

Approximately 200 feet in elevation above the outcrop of the lower vein at the entrance to the upper drift, an "upper vein" outcrops, which strikes about due east, and has an almost vertical attitude. This vein consists dominantly of quartz which carries more or less disseminated galena and pyrite with their oxidation products including lead carbonate which is quite prominent near the surface. An adit 35 feet long has been driven in to crosscut this vein, and from the end of the adit a drift has been run along the vein for about 75 feet in a southerly direction. The vein as exposed in the roof of the drift has a thickness of from 4 to 20 inches; and average samples taken across the vein at close regular intervals are claimed to contain from $5 to $18 per ton in gold, silver, and lead.

The ore material from these veins could not be shipped at a profit, as taken from the mine. It is, however, well adapted to concentrating operations and could be concentrated at least 7 to 1. The veins outcrop on the steep western face of Mt. Anderson between 1,300 and 1,800 feet above Becker creek opposite; and this hill-side affords a good site for a mill to which the ore could readily be conveyed from the mine workings by tramways or shoots. Becker creek affords ample water for milling and power purposes, and there is sufficient timber for all ordinary mining requirements for years to come in the valleys of Becker creek and Wheaton river, within a reasonable distance. A government wagon road has been constructed from Robinson on the White Pass and Yukon railway up Wheaton river, and a branch from this road continues up Becker creek to a point immediately below the outcrops of the veins on this property, a distance from Robinson of 25 miles. The railway has recently contracted to haul ore from the Whitehorse Copper belt to Skagway for $1.10 per ton, and the Whitehorse Copper belt is about 30 miles farther from Skagway than Robinson. From Skagway to the Tacoma or some other coast smelter, the rate on ore is from $2.00 to $2.50 per ton, making a total from Robinson of probably between $3.00 and $3.50 per ton. Additional haulage charges would have to be added for transport by road over the 25 miles from the mine to Robinson.

Antimony-Silver Veins.

General Statement. All the deposits of antimony ores that have been discovered in Wheaton district are appropriately included under the term antimony-silver veins, and mostly all of them occur on the western or northwestern slope of Carbon hill facing Wheaton river. One important vein of this type, however, occurs at the head of a tributary of Becker creek on the eastern side of Carbon

hill, and two or three others have been found on Chieftain hill and in that vicinity, across Wheaton valley from Carbon hill. Most of these deposits have been previously described,[1] but since this district was last investigated, considerable development work has been performed on Carbon hill, and the deposits there are much better understood than formerly. Also since the outbreak of the war, the demand for antimony has so increased that it is considered advisable to summarize the information concerning these deposits.

The antimony in the antimony-silver veins occurs dominantly in the form of stibnite (antimony sulphide), although some jamesonite (an antimony lead sulphide) is also found, These minerals are accompanied by galena, grey copper, zinc blende, and in some cases by arsenopyrite, which occur in a gangue composed mainly of quartz but including also some calcite and barite. Some of the veins contain important amounts of silver, but these are in most cases low in antimony, and, those high in antimony are as a rule low in silver. In a few places, however, both silver and antimony occur together in important amounts. The veins all occupy fissures in the containing rocks which are for the most part the Coast Range granitic intrusives. Occasional veins, however, are found in the Mesozoic andesitic rocks which are older than the Coast Range intrusives.

By far the greater number of the antimony-silver veins of Wheaton district, occur on the western face of Carbon hill, and of these nearly all are covered by a group of claims, that is here designated the Fleming property. A few other veins have been located on this slope of Carbon hill. The deposit on the east side of Carbon hill occurs on a claim owned by Messrs. Becker and Cochran, which is here termed the Becker-Cochran property. The deposits occurring on Chieftain hill and in that vicinity will be here so designated.

Chieftain Hill and Vicinity. The only vein of any importance that is known to have been found on Chieftain hill, is exposed in a prominent draw on the eastern face of the mountain, about halfway to the summit. Two claims named respectively the Morning and Evening claims were formerly located on this deposit,[2] but these have lapsed, and other locations have been made. Some development work was at one time performed on this vein, but when visited this past summer (1915), the cuts or trenches had so caved in as to completely obscure the outcrop. The vein occurs in a fissure in andesitic rocks, strikes about due west, and has a nearly perpendicular attitude. The deposit also consists chiefly of quartz which is in places well mineralized with stibnite, and carries also subordinate amounts of zinc blende. At one point the vein is 5 feet in thickness, 2 feet of which appears to be composed almost entirely of stibnite. The vein, however, narrows rapidly in each direction from this point.

An important vein carrying antimony minerals is reported to have been recently discovered on Berney creek, a short distance to the southwest of Chieftain hill, but this was not seen by the writer.

Fleming Property. A group of six mineral claims situated on the western or northwestern face of Carbon hill, is owned by Mr. W. J. Fleming of Chicago, who also holds a timber tract of 160 acres at the base of the hill below these claims. This group includes the claims formerly described as the Porter group.[3]

Quite a number of veins have been discovered on this property, possibly between 15 and 20, the exact number being uncertain, due to the fact that in some cases insufficient development has been performed to make correlations sure, so that certain outcrops may belong to the same or different veins. The greater number of these veins occur in the Coast Range granitic intrusives, but a few are found in the Mesozoic andesitic rocks. The development includes not

[1] Cairnes, D. D., "Wheaton district, Yukon Territory"; Geol. Surv., Can., Memoir No. 31, 1912, pp. 113-129.
[2] Ibid, p. 129.
[3] Ibid, pp. 126-128.

only a considerable amount of systematic surface work, but also about 1,100 feet of underground crosscuts and drifts. The veins range in thickness, in most places, from a few inches to 3 feet, although for short distances, some may be more than 3 feet thick, but even 2 feet is somewhat exceptional. The vein material, in places, contains as much as 50 per cent antimony, but average samples across the veins rarely carry more than 20 to 25 per cent, and in most cases contain less than 20 per cent. The gold content is prevailingly small in amount, rarely exceeding $2 per ton, and being generally less than $1. The silver and lead values are, however, quite important. Average samples across the veins contain occasionally 50 ounces or more of silver to the ton, but from 15 to 30 ounces is more representative of the richer silver veins, and in most places the average silver content ranges from a trace to 5 ounces. The lead in average samples rarely occurs in greater amounts than from 7 to 15 per cent, and in most cases under 5 per cent and often under 1 per cent. The combined values in gold, silver, and lead, amount in rare instances to $50 or more per ton, but from $10 to $20 is rather exceptional, and by far the greater number of average samples that have been taken from most of the veins run less than $5 per ton. The samples taken from one or two of the best veins such as the "big vein," however, average approximately $10 per ton in gold, silver, and lead, *i.e.* without allowing for the antimony. These results are computed as the result of the assaying of upward of 300 samples by the Department of Mines, Ottawa, by the government assayer at Whitehorse, and by others.

Other Veins on the West Slope of Carbon Hill. The only other veins of any importance that are known to have been found on the west slope of Carbon hill, are the two parallel veins referred to in the writer's previous report as occurring on "Goddell's claims."[1] These veins occur about one mile to the north of the Fleming group, and are not more than 20 or 30 feet apart. They outcrop in a gulch and are distinctly exposed to view, extending up the mountain side for a distance of over 2,000 feet. They occur in the Coast Range granitic rocks, strike south 83 degrees west, and have an almost perpendicular attitude. The veins are 2 feet, and 2 feet 6 inches thick respectively, and consist chiefly of quartz which carries a certain amount of jamesonite and arsenopyrite, the antimony content being very low.

Becker-Cochran Property. A vein outcrop containing considerable stibnite is located on a claim owned by Theodore Becker and Howard Cochran, which is situated on the east side of Carbon hill, at an elevation of about 4,950 feet above the sea. This outcrop occurs near the head of a small northerly tributary of a creek locally known as Conglomerate creek which joins Becker creek from the west about 3 miles above its mouth. The vein is here possibly about 3 to 4 feet in thickness, but as it had not been stripped when visited and as the only work that had been performed had caved in, very little definite information was available. A number of large pieces of vein material from 1 foot to 2½ feet in thickness were scattered along the outcrop of the vein, some of which appeared to be composed almost entirely of stibnite, and all contained considerable of this mineral. Two samples were taken from these masses or vein fragments. No. 1 is intended as an average of all the vein material in sight. No. 2 is an average of all the better mineralized pieces. These samples were assayed and found to contain:

Sample No.	Gold	Silver	Antimony
1	Trace	Trace	21·20%
2	Trace	Trace	40·62%

[1] Ibid, pp. 128, 129.

Conclusions. At present exceptionally high prices are being paid for antimony minerals, also the White Pass and Yukon Railway Company is now offering very low rates on ore shipments to Skagway to encourage the lode mining industry of Yukon. The antimony-silver ore would of necessity have to be sorted or concentrated before shipping, but in places limited amounts of shipping ore could be obtained by merely hand sorting. For any considerable tonnage, however, the ores would require to be concentrated. On Carbon hill very favourable natural facilities are provided for the erection of a concentrating mill, and a government wagon road has been constructed from Robinson to Carbon hill a distance of 30 miles, with a down grade all the way to the railway. It would thus seem practically certain that some of these veins could now be worked at a profit, particularly if a concentrator were erected in the near vicinity; and it is hoped these deposits will become producers in the near future.

Silver-Lead Veins.

Veins of the silver-lead type are limited in their occurrence in Wheaton district, so far as is known, to one small area situated on the east slope of Idaho hill, facing Annie lake. These veins were formerly all located and covered by two groups of claims known as the "Union Mines" and "Nevada Mines." Practically no work has been performed on these deposits since they were last examined so the reader is referred to the writer's former report[1] for descriptions of these deposits. There is undoubtedly a certain amount of fairly good ore contained in these veins, but it is doubtful if any of it is sufficiently high grade to pay for mining, shipping, and treatment, without concentration before shipment, and the veins do not appear to be sufficiently extensive or persistent to warrant the erection of a concentrating mill in their vicinity.

Coal.

The only locality in Wheaton district in which coal has been found is on Mt. Bush. There, several seams of semi-anthracite have been discovered, ranging from 18 inches to 6 feet or more in thickness. These seams have been very slightly explored or investigated, and little is known concerning them. They are, however, known to be considerably disturbed by basaltic dykes, several of which intersect them; this might nevertheless not seriously interfere with the economic working of these deposits which should be of value for local consumption, when the demand arises. For further details concerning these coal measures, the reader is referred to the writer's previous report.[2]

[1] Ibid, pp. 129-139
[2] Ibid, pp. 145 147.

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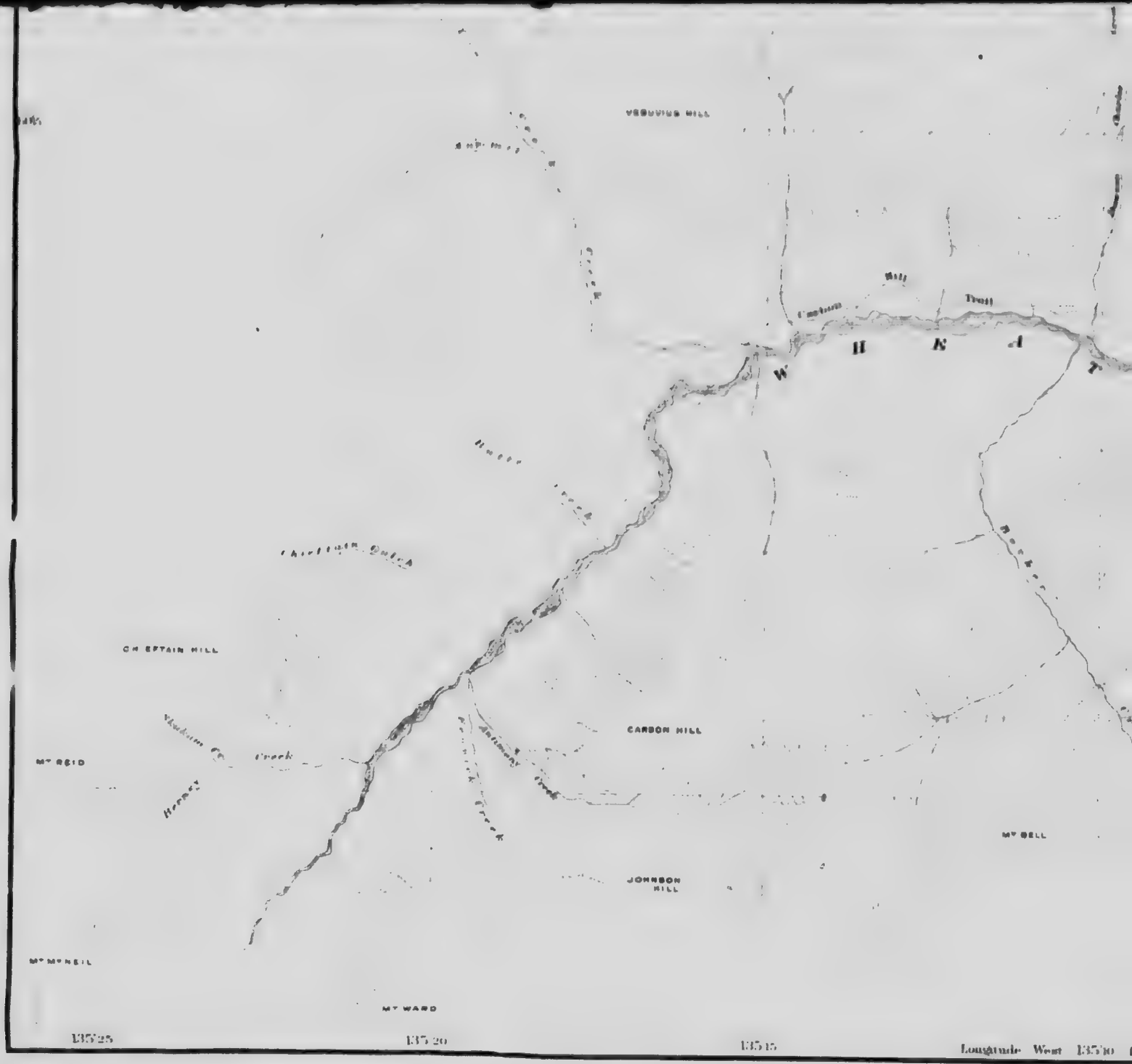
Canada
Department of Mines

MINISTER R.G. McCONNELL DEPUTY MINISTER

GEOLOGICAL SURVEY



C. O. Senecal, *Geographer and Chief Draughtsman*
E. H. Norman, *Draughtsman.*

MAP 59 A
Issued 1915

WHEAT

YUKON TERR

Scale, 62.5

Miles

Kilometres

Note. For practical purpo
1 MILE TO 1

To accompany Memoir by D. D. Cairnes

MAP 59 A
Issued 1915

EATON

TERRITORY

ale, 62,500
Miles
Kilometres

ctical purposes assume
E TO 1 INCH

TOPOGRAPHY
Control, subject to revision

PLOTTED SURVEYS BY D D CAIRNES 1900
COMPILATION BY A G HAULTAIN and D A NICHOLS 19[illegible] 1912

135°25
135°20
135°15
60°
60°05
Summit Creek Pass
Tantalus
Summit
Carbon
MTHODNETT
W
H
E

LEGEND

QUATERNARY	RECENT AND PLEISTOCENE	I **Superficial deposits** *Sand, gravel, silt, clay, and muck, volcanic ash, ground ice, slide rock and mineral materials*
TERTIARY		II *Rhyolite, granite porphyry, and related volcanics with their associated tuffs and breccias*
		III *Basalt, andesite, and related volcanics with their associated tuffs and breccias*
		IV **Coast Range intrusives** *Granitic rocks ranging in composition from granite to diorite, with associated porphyritic phases*
MESOZOIC	CRETACEOUS TO JURASSIC	V *Andesite, basalt and diabase with their associated tuffs and breccias*
		VI **Tantalus conglomerate** *Conglomerate, with some sandstone, shale, and breccia of coal*
		VII **Laberge series** *Argillite, shale, sandstone, arkose, greywacke, conglomerate, and tuff*
PALÆOZOIC	CARBONIFEROUS	VIII *Limestone, more or less dolomitic*
	DEVONIAN?	*Peridotite and serpentine*
PRE-CAMBRIAN		X **Mount Stevens group** *Schist, gneiss, quartzite, and limestone*

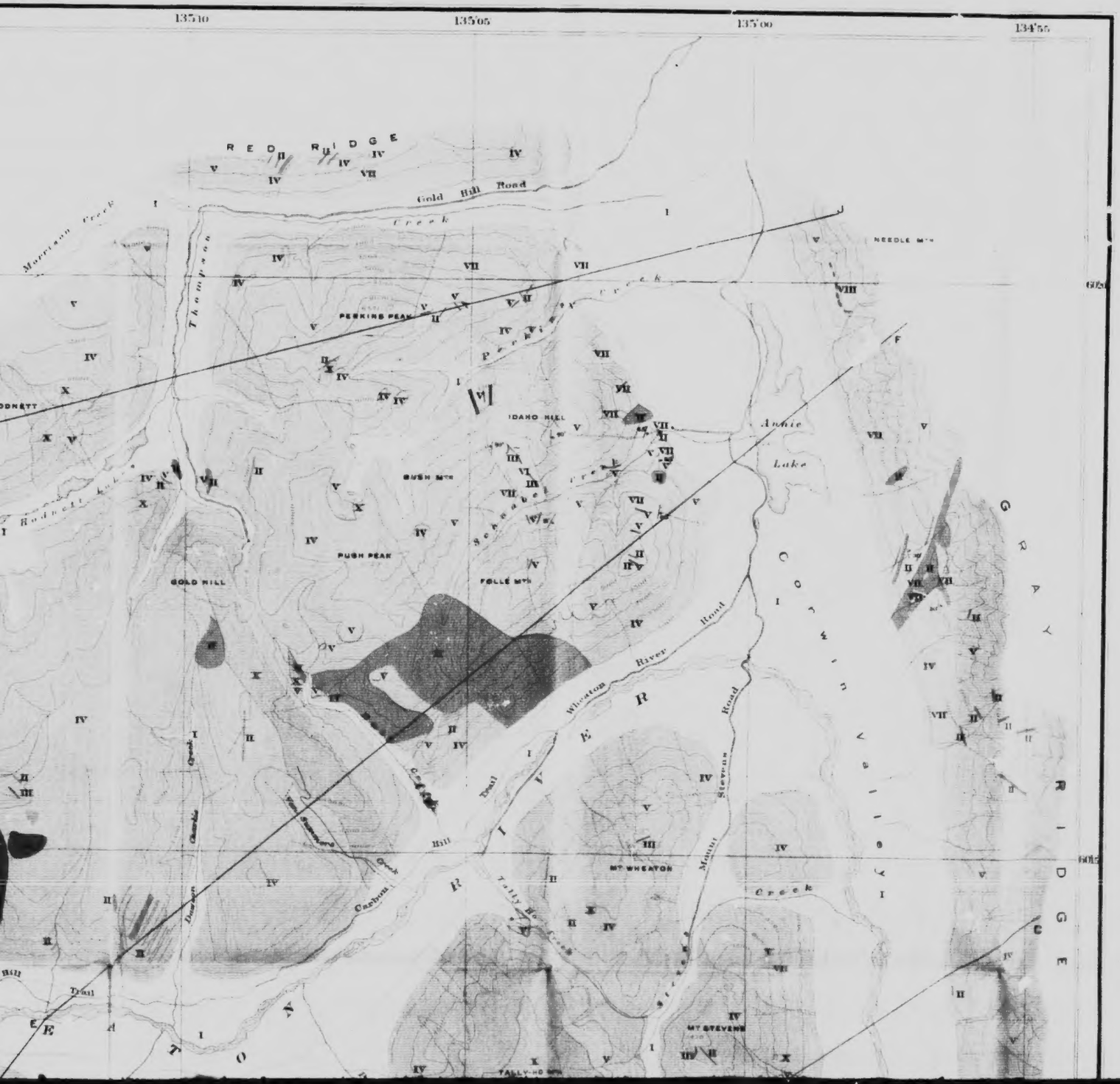
Symbols

Canada
Department of Mines

HON. E. L. PATENAUDE, MINISTER. R. G. McCONNELL, DEPUTY MINISTER.

GEOLOGICAL SURVEY

Structural section along line G H I J



LEGEN

Culture

Buildings

Roads

Park trail

Bridges

Water

Rivers and la

Streams

Watercourse

Fresh marsh

Relief

Contours

PRE CAMBRIAN

Mount Stevens group
Schist, gneiss, quartzite, and limestone

Symbols

Geological boundary
observed

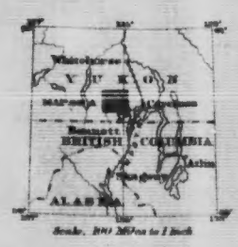
Geological boundary
assumed

Dip and strike

C.O. Senécal, *Geographer and Chief Draughtsman.*
R.B. Weston, *and A. Braidwood, Draughtsmen.*

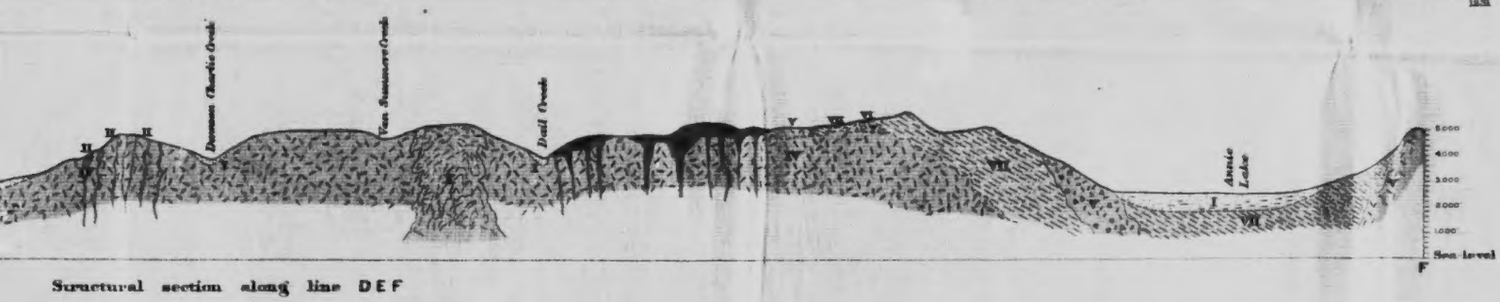
Struc

Struc

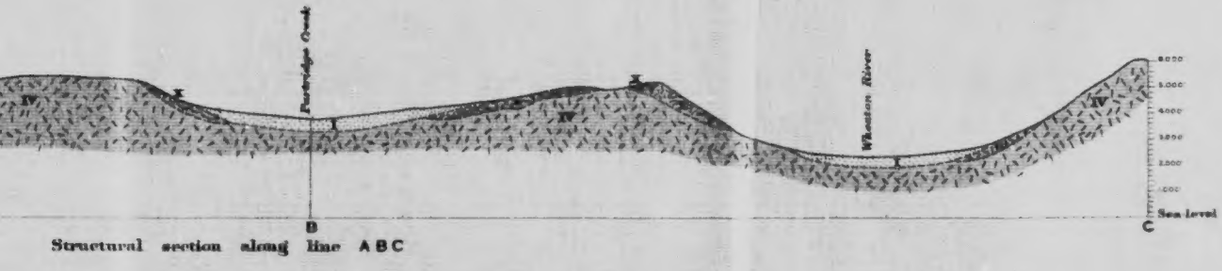


To accompany Memoir by D.D. Cairnes

Longitude West 135°10' from Greenwich 135°05 135°00 134°55'



Structural section along line DEF



Structural section along line ABC

MAP 60 A
(Issued 1917)

WHEATON
YUKON TERRITORY

Scale 1/62500

Miles

Kilometres

Note. For practical purposes assume
1 MILE TO 1 INCH

TOPOGRAPHY
(Control, subject to revision.)

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COMPILATION BY A. G. HAULTAIN AND D. A. NICHOLS. 1911 1912

GEOLOGY

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